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Light therapy tackles eye injuries

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People blinded by light could be treated with more light. Researchers have found that shining near-infrared radiation on damaged retinal cells can keep them alive and prevent permanent blindness.

If the infrared technique works in people, it could be used to treat a wide range of eye injuries and diseases. And it does not stop there.



(Photo: Corbis Sygma)

Other studies have shown that infrared light can help heal all sorts of injuries and sores, and it is already being used to treat severe mouth ulcers in children undergoing chemotherapy.

Cell powerhouses

In the late 1990s, lab studies on cells showed that near-infrared wavelengths can boost the activity of mitochondria, the crucial powerhouses in cells. That caught the attention of NASA, which hoped it could use the technique to treat astronauts in space, where injuries heal more slowly than on Earth, possibly because mitochondria do not function properly.

The treatment requires high-intensity light, but instead of lasers, NASA has developed powerful light-emitting diodes for the job. Lasers tend to damage cells, whereas LEDs can deliver light in a way that is less harmful to tissue (New Scientist magazine, 25 September 1999, p 20). Now Harry Whelan, a neurologist at the Medical College of Wisconsin in Milwaukee, and his colleagues have put the LEDs to the test on eye injuries.

In a study that will appear in *Proceedings of the National Academy of Sciences*, Whelan blinded rats by giving them high doses of methanol, or wood alcohol. This is converted by the body into formic acid, a toxic chemical that inhibits the activity of mitochondria. Within hours, the rats' energy-hungry retinal cells and optic nerves began to die, and the animals went completely blind within one to two days.

But if the rats were treated with LED light with a wavelength of 670 nanometres for 105 seconds at 5, 25 and 50 hours after being dosed with methanol, they recovered 95 per cent of their sight. Remarkably, the retinas of these rats looked indistinguishable from those of normal rats. "There was some tissue regeneration, and neurons, axons and dendrites may also be reconnecting," says Whelan.

Painful sores

The results have raised the hope that the LED technique could be used to treat people for a range of eye diseases known to be caused by mitochondrial problems. Whelan also thinks it will help treat laser injuries to the retina, apart from areas where cells have been completely destroyed.

Whelan has already tested the LEDs on 30 children suffering from mucositis, a painful side effect of cancer chemotherapy. The children had painful sores in their mouths and throats and were unable to eat or drink, he says.

The LED treatment eliminated the mucositis and is now being used to prevent it. "It's a night and day difference in the children's floor," he says. The results appeared in the *Journal of Clinical Laser Medicine and Surgery* in December last year. The Food and Drug Administration has now approved further trials in hospitals, which will use LEDs donated by NASA.

What is not yet clear is exactly how the light stimulates healing. But Britton Chance of the University of Pennsylvania has shown that about 50 per cent of the near-infrared light is absorbed

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by mitochondrial proteins called chromophores. Whelan and his colleagues think the light boosts the activity of a chromophore called cytochrome c oxidase, a key component of the energy-generating machinery.

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